

WHAT IS CLAIMED IS:

1. A thermally-assisted magnetic recording head capable of recording information magnetically on a recording medium, comprising:

a laser device configured to emit a light to heat the recording medium to reduce magnetic coercive force thereof;

a light absorbing film provided between the laser device and the recording medium, the light absorbing film having an aperture through which the light is applied to the recording medium; and

a magnetic pole configured to record the information magnetically on the recording medium by applying recording magnetic field to the recording medium having the reduced coercive force,

the aperture being adapted so that a polarizing direction of the light emitted from the laser device is approximately perpendicular to a direction along a longitudinal extension of recording tracks formed on the recording medium, and

a width W1 of the aperture taken along the polarizing direction being smaller than a width W2 of the aperture taken approximately perpendicular to the polarizing direction.

2. The thermally-assisted magnetic recording head according to claim 1, wherein the width W1 is shorter than 1/2 of a wavelength at the center of a spectrum of the light emitted from the laser device.

3. The thermally-assisted magnetic head according to claim 1, further comprising a dielectric film provided between the laser device and the light absorbing film.

4. The thermally-assisted magnetic head according to claim 3, wherein an optical film thickness of the dielectric film is in a range from  $0.05\lambda$  to  $0.35\lambda$  relative to the wavelength  $\lambda$  of the light emitted from the laser device.

09772504-011101

5. The thermally-assisted magnetic recording head according to claim 1, wherein the width W1 is within a range in which an absorption loss through the aperture of light having an electric field vector perpendicular to the direction of the aperture width W1 is 10 times as much as an absorption loss through the aperture of light having a magnetic field vector perpendicular to the direction of the aperture width W1, or even higher.

6. The thermally-assisted magnetic recording head according to claim 1, wherein the laser device is a semiconductor laser device of which laser oscillation mode is a TM mode.

7. The thermally-assisted magnetic recording head according to claim 1, further comprising an optical light collector which converges the light emitted from the laser device to direct it into the aperture.

8. The thermally-assisted magnetic recording head according to claim 1, wherein the aperture is filled with dielectric or semiconductor material.

9. The thermally-assisted magnetic recording head according to claim 1, further comprising a reproducing device configured to reproduce the information recorded on the recording medium.

10. A thermally-assisted magnetic recording apparatus capable of recording information magnetically on a recording medium, comprising:

- a thermally-assisted magnetic recording head; and
- an actuating mechanism configured to move recording medium and the magnetic recording head relative to each other, wherein the thermally-assisted magnetic recording head includes
  - a laser device configured to emit a light to heat the recording medium to reduce magnetic coercive force thereof;
  - a light absorbing film provided between the laser device

and the recording medium, the light absorbing film having an aperture through which the light is applied to the recording medium; and

a magnetic pole configured to record the information magnetically on the recording medium by applying recording magnetic field to the recording medium having the reduced coercive force,

the aperture being adapted so that a polarizing direction of the light emitted from the laser device is approximately perpendicular to a direction along a longitudinal extension of recording tracks formed on the recording medium, and

a width of the aperture taken along the polarizing direction being smaller than a width of the aperture taken approximately perpendicular to the polarizing direction.

11. The thermally-assisted magnetic apparatus according to claim 10, further comprising a recording medium,

the recording medium including a record layer in which magnetic information is recorded, and an antireflection layer made of dielectric or semiconductor material deposited over the record layer.

12. A thermally-assisted magnetic recording head capable of recording information magnetically on a recording medium, comprising:

a heating source configured to irradiate the recording medium with a heat beam to reduce magnetic coercive force of the recording medium; and

a magnetic pole configured to apply recording magnetic field to the recording medium having the reduced coercive force,

a radiating portion emitting the heat beam of the heating source being in a receding position from a tip of the magnetic pole when seen from the recording medium, and the tip of the magnetic pole protruding between the heating source and the recording medium.

13. The thermally-assisted magnetic recording head

according to claim 12, wherein an aperture is provided close to the tip of the magnetic pole so that at least part of the heat beam emitted from the heating source is transmitted through the aperture.

14. The thermally-assisted magnetic recording head according to claim 12, wherein the heating source is an edge-emitting semiconductor laser device having an active layer and cladding layers, and

the tip of the magnetic pole protrudes between the cladding layer and the recording medium.

15. The thermally-assisted magnetic recording head according to claim 12, further comprising a converging means for converging the heat beam provided between the heating source and the recording medium.

16. A thermally-assisted magnetic recording apparatus capable of recording information magnetically on a recording medium, comprising:

a thermally-assisted magnetic recording head, and  
an actuating mechanism configured to move recording medium and the magnetic recording head relative to each other,  
wherein the thermally-assisted magnetic recording head includes

a heating source configured to irradiate the recording medium with a heat beam to reduce magnetic coercive force of the recording medium, and

a magnetic pole configured to apply recording magnetic field to the recording medium having the reduced coercive force,

a radiating portion emitting the heat beam of the heating source being in a receding position from a tip of the magnetic pole when seen from the recording medium, and the tip of the magnetic pole protruding between the heating source and the recording medium.

17. A method of manufacturing a thermally-assisted

magnetic recording head including a heating device configured to irradiate the recording medium with a heat beam to reduce magnetic coercive force of the recording medium, and a magnetic pole configured to apply recording magnetic field to the recording medium having the reduced coercive force to record information thereon magnetically, comprising the steps of

connecting a first substrate onto a second substrate, the heating device being to be formed in the first substrate while the magnetic pole is to be formed in the second substrate,

fabricating the heating device on the first substrate,

applying a material transparent to light in a path in the heating device, the heat beam being emitted through the path, and

fabricating the magnetic pole on the second substrate above the heating device, above the material transparent to light, and around them,

the material transparent to light having a distribution uneven thickness so that a tip of the magnetic pole protrudes between the heating device and the recording medium.

18. A method of manufacturing a thermally-assisted magnetic recording head including a heating device configured to irradiate a recording medium with a heat beam to reduce magnetic coercive force of the recording medium, and

a magnetic pole configured to apply recording magnetic field to the recording medium having the reduced coercive force to record information thereon magnetically, comprising the steps of

fabricating the heating device on a first substrate,

connecting the first substrate onto a second substrate, the heating device having been prefabricated in the first substrate while the magnetic pole is to be formed in the second substrate,

applying a material transparent to light in a path in the heating device, the material transparent to light being over either the first substrate or the second substrate, and the heat beam being emitted through the path, and

fabricating the magnetic pole on the second substrate above the heating device, above the material transparent to light, and around them,

the material transparent to light having a distribution uneven thickness so that a tip of the magnetic pole protrudes between the heating device and the recording medium.

19. A method of manufacturing a thermally-assisted magnetic recording head including a heating device configured to irradiate a recording medium with a heat beam to reduce magnetic coercive force of the recording medium, and

a magnetic pole configured to apply recording magnetic field to the recording medium having the reduced coercive force to record information thereon magnetically, comprising the steps of

fabricating the heating device on a first substrate,

fabricating the magnetic pole on a second substrate, with its tip being directed upward, and

connecting the heating device and the magnetic pole with the first substrate and the second substrate being opposed to each other, so that the tip of the magnetic pole protrudes between the heating device and the recording medium.